independent Claim 15 recites a source power of about 100-450 watts, and a bias power of about 200-500 watts.

These claims stand rejected as anticipated, 35 U.S.C. §102(b), by U.S. Patent 5,545,289, Chen, or obvious, 35 U.S.C. §103, taken in view of Chen and further in view of U.S. Patent 5,853,602, Shoji. These rejections are respectfully traversed.

Applicant turns first to the rejection of Claims 1-12, which do not recite specific source and bias power relationships. It is the position of the Examiner that Chen discloses a dual etching system which meets the claims. In fact, the reference to Chen is not about etching at all, and includes, at best, an incidental etching description. The Chen reference is directed to passivation and stripping following etching. Chen does in fact describe two different etching chemistries, the first being recited at column 12, lines 36-37, column 13, lines 48-49 and column 16, lines 58-59. In each of these examples 1-53, a single etchant chemistry is used, which employs a $BCl_3/Cl_2/N_2$ etchant chemistry. This fails to teach the claimed invention. It specifically and expressly includes BCl_3 as a source of chlorine, which is excluded herein.

The Examiner relies on the two-step etching process described for Examples 54 and 55, column 19, line 56 - column 20, line 22. In this two-step etch, a first etchant of $BCl_3/Cl_2/N_2$ is introduced, and then a second etchant of identical formulation is added. Applicant respectfully submits that the reference is inadequate to teach the claimed invention. To the extent the reference teaches anything at all, it teaches etchant chemistry wherein BCl_3 is used as a chlorine source, in major amounts. (Note that according to the formulations, BCl_3 is present in the greatest amounts).

Accordingly, this rejection is respectfully traversed.

The Examiner further relies on the combination of Chen, discussed above, taken in view of Shoji to render Claims 5, 7-8 and 12-35 obvious. The rejection is respectfully traversed for a variety of reasons.

Initially, with respect to Claims 5 and 7, which require a fluorine source in the first etchant, the Examiner relies on Shoji which teaches an etching process which uses SF_6/Cl_2 and CO. The Examiner asserts that it would be obvious, given Shoji to arrive at the claimed invention. Applicant respectfully submits that the Examiner is picking and choosing from the references, in light of Applicant's teaching. Indeed, the attention of the Examiner is respectfully directed to the Interview Summary Sheet of January 29, 2002, wherein reference is made to the proposed amendments, and SPE Benjamin Utech wrote "proposed amendment was discussed and offered to overcome Shoji." As reflected in Applicant's Amendment of April 22, 2002, the proposed amendment, the exclusion of fluorine from the second etchant composition, was introduced into the claims. Shoji expressly teaches that where a two-stage etchant is to be used, fluorine should be included. Column 5, lines 6-9.

It appears that the Examiner's rejection is premised on a combination of the first-etch chemistry of Shoji, combined with the second-etch chemistry of Chen. Applicant respectfully submits that this is contrary to the teaching of Shoji, which specifically teaches selective use of the two specific etchants described. See column 2, lines 22-23. How would one of ordinary skill in the art conclude that the dramatically different etchant chemistry of an incidental teaching in Chen should be substituted for that of Shoji? In any event, Applicant respectfully submits that one of ordinary skill in the art would not pick and choose gases from among the first and second etchant chemistries, as apparently done by the Examiner, but would, at best, combine a first stage with a second stage. In Chen's first stage, and in Chen's second stage, BCl_3 is used as a chlorine source, excluded from the claims. It doesn't really make a difference which combination is used. If one selects the first step of Shoji, using $SF_6/Cl_2/CO$, then one would necessarily select the second step from Chen, and introduce BCl_3, as a chlorine source, again excluded by the claims. Accordingly, Applicant respectfully submit that the combination of Shoji and Chen is made in light of

Applicant's teaching, and not what the references fairly teach those of skill in the art. Even if selectively combined, the references fail to teach the claimed invention.

Claims 12-35 Are Admittedly Free of the Prior Art

The Examiner concedes that the characterizing recitations of Claims 12-35, which go to the relatively amounts of source power and bias power employed in the etching process, are nowhere taught in the art. Office Action, page 3, last paragraph. The Examiner characterizes these as "result-effective process parameters." Respectfully, the Examiner has mischaracterized the arts teaching. Nothing in either Shoji or Chen, or the other art identified indicates either source power or bias power, much less their ratio, to be a "result-effective process parameter." In the absence of such teaching, an otherwise unsupported conclusion that optimization is straightforward is insufficient to support a rejection under 35 U.S.C. §103. This issue was laid to rest nearly thirty years ago, In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). The reviewing Court expressly rejected the position that it would be obvious to vary every parameter of a system in order to optimize effectiveness "if there is no evidence in the record that the prior art recognized that a particular parameter effected the result." 559 F.2d at 620. Indeed, even the Examiner's rejection appears to recognize that at best, the Examiner is inviting experimentation, an "obvious to try" standard. From page 4 of the Office Action:

> [I]t is the Examiner's position that the variation of result-effective process parameters, such as concentration and power, would have been obvious to one of ordinary skill in the art, if only for experimentation purposes, in order to determine the optimum process conditions. (Emphasis supplied).

The Antonie Court, which soundly rejected the assertion that if a parameter is not identified, in the art, as result-effective it would nonetheless be obvious to optimize, also rejected the "obvious to try" standard. "Disregard for the unobviousness of the results of 'obvious to try' experiments disregard the 'invention as a whole' concept of Section 103." Id., citing In re Dien, 371 F.2d 886,

152 USPQ 550 (CCPA 1967).

Fundamentally, the Examiner has gone in the face of Antonie, which noted exceptions to the rule that "the discovery of an optimum value of a variable in a known process is normally obvious." As is the case herein, in Antonie, the CCPA found that where "the parameter optimized was not recognized to be a result-effective variable" constitutes an exception to that Rule. Id. Withdrawal of the rejection of Claims 12-35, independent of the etchant chemistry of the prior art, is accordingly, respectfully requested.

In light of all the foregoing, Applicant respectfully submit that the claims stand free of the prior art. As they otherwise are unrejected, they are in conformance with the requirements of Title 35, and an early and favorable action thereon is respectfully requested.

Respectfully submitted,

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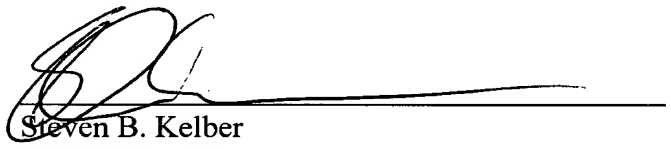

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MARKED-UP COPY OF AMENDED CLAIMS

1. A method for etching a semiconductor device to form an etched pattern therein, comprising:

(a) providing a semiconductor device having a plurality of layers, at least one of the layers of the semiconductor device comprising a refractory metal-containing material; and

(b) etching the semiconductor device under conditions with an etchant composition comprising a first etchant chemistry which comprises a chlorine source free of BCl_3 and a second etchant chemistry which is free of fluorine.

15. A method of etching a refractory metal-containing layer and an oxide layer, the method comprising:

(a) etching the refractory metal-containing layer to an end point using a first etchant chemistry at a source power of from about 100 watts to about 450 watts and a bias power of from about 200 watts to about 500 watts, wherein the first etchant chemistry comprises a chlorine source free of BCl_3 and a fluorine source; and

(b) etching partially through the oxide layer using a second etchant chemistry, wherein the second etchant chemistry is free of fluorine and comprises a chlorine source.

31. A method of etching a semiconductor device using a capacitive coupling plasma reactor to form a pattern on the semiconductor device, comprising:

(a) providing a semiconductor device having a plurality of layers, at least one of the layers of the semiconductor device comprising a refractory metal-containing material; and

(b) etching the semiconductor device with an etchant composition at a bias power of from about 100 watts to about 750 watts, wherein the etchant composition comprises a first etchant chemistry comprising chlorine free of BCl_3 and a second etchant chemistry free of fluorine.